Volume 19 March, 1933 *Number 3*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Steel Mill Operations

Attainment of Lubrication Economy

Lubrication of Overhead Cranes

PUBLISHED BY

THE TEXAS COMPANY

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TEXACO LUBRICATION RECOMMENDATIONS

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Steel Mill Operations

Attainment of Lubrication Economy

STEEL mill operations, particularly in the lubrication of rolling equipment and overhead travelling cranes, represent a field for development of greater economy from the lubrication angle, particularly in view of the fact that these economies will extend beyond the mere cost of lubricating oils and greases which may be saved.

Means and methods of lubrication require intelligent study; properties of lubricants must be investigated, especially from the viewpoint of load-carrying and heat resisting ability, and the conditions of service must be analysed. Complete understanding of the above, and realization that they are all closely related, will be of marked aid to the executive in choosing a range of lubricants which will protect the wearing elements, reduce the hazard to personnel, and insure production with the least unnecessary cost due to wasted lubricants, contaminated materials, injury to workmen, or damaged machinery.

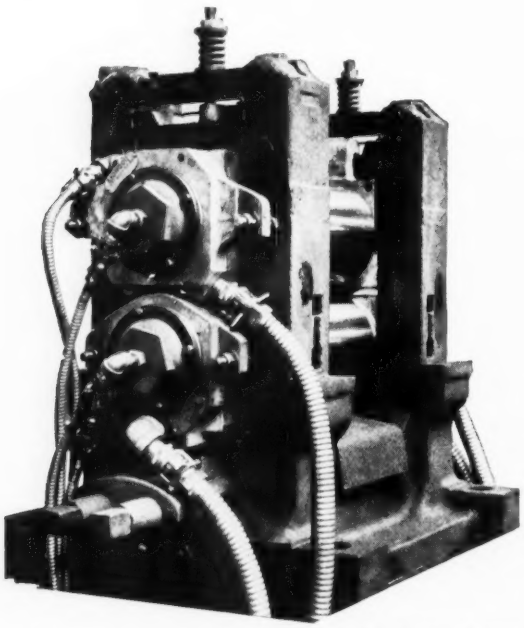
The problems pertinent to the operation of steel mill gears and bearings vary widely. Loads are frequently excessive, vibration is virtually continuous, and the prevailing shocks which result from impact of ingots, billets, etc., upon the roll surfaces react upon the roll neck bearings and back through the pinion stands and reduction drives to the power unit in practically any type of mill. The same holds true on ingot and charging car bearings. Unless the resultant loads can be readily carried by the bearing lubricant, and unless there is adequate provision to prevent squeezing out of this latter, the life of the bearing will be markedly reduced. Somewhat similar conditions prevail in the operation of hot saws. Here, however, there is the added element of speed which, coupled with the severity of the load and the frequency with which it must be absorbed in its full intensity by the bearings, often subjects the saw mountings to duty so severe as to reduce their effective life.

But load, shock, vibration, speed, and high temperature are not the only factors which must be considered. One must also realize that the contaminating effects of dust, dirt and water, as well as the abrasive nature of the former, may lead to impaired lubrication and abnormal bearing wear.

In the interest of bearing and gear protection, there has always been a tendency among certain plant operators to use an excess of lubricants. Abnormal use of lubricants, however, gives no positive assurance that wear will be effectively reduced, or operation insured for any longer periods of time than where just the right amount is employed.

To overcome this tendency, designers of lubricating equipment have devoted much time, energy and expense, in the interest of developing automatic devices which will effectively meet average mill requirements. By reason of the cooperation which has been afforded by authorities in the steel and petroleum

industries, sufficient progress has been made to warrant the prediction that adoption of completely automatic lubrication will be one of the outstanding improvements which will accompany return to normalcy.



Courtesy of Morgan Construction Company

Fig. 1—End view of a steel rolling mill, equipped with "Morgoil" sleeve type roll neck bearing. This bearing is designed for connection to the oil circulating system. By virtue of unit construction of this bearing renewal is practicable without exposing bearing surfaces to mill dirt or scale.

THE TREND TOWARD PRESSURE LUBRICATION

Positive lubrication has been the ideal of the steel mill operator for many years. In this regard, the advantage of pressure was soon realized. The earlier developments were more or less confined to unit devices, especially where greases were involved, although the mechanical force feed oiler has always been adapted to serve a number of wearing parts. This latter device, however, is more suited to prime moving elements, such as blooming mill engines and other steam drives, its capacity being somewhat limited for the requirements of rolling mill equipment. Furthermore, it requires installation in a safe, accessible location.

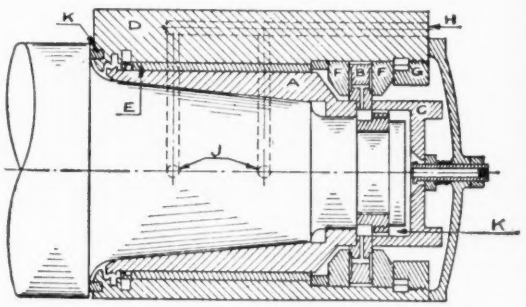
This proviso also applies to the pressure grease cup, due to the frequent necessity for manual adjustment.

The study of means for centralized pressure grease lubrication, therefore, became a logical consequence, along with the design of somewhat similar systems for the application of more fluid lubricants. As a result, today, lubrication by means of centralized pressure can involve either grease or oil according to the design of the lubricating system. The features of any such means of lubrication, under adequate pressure, include positive delivery of lubricant to insure maintenance of a sufficient film between the bearing surfaces, the exclusion of non-lubricating foreign matter, decided economy of lubricants, a minimum of hazard in handling or filling, and scarcely any supervision after proper adjustment.

Grease Systems

Centralized control in connection with the distribution of comparatively heavy bodied lubricants has been a most interesting development in the study of automatic lubrication. There are a number of ways by which the lubricant can be controlled, and impelled to the various points of delivery. In all, however, power in some form or other must be used. Where positive piston displacement types of metering valves are employed at each point to be lubricated, hydraulic power has been found to be especially adaptable, as a means of valve control. In such a system either one or two lubricant supply lines can be connected to each valve according to the nature of the service. For heavy duty machinery, such as is encountered in the steel mill, dual lines are employed. Here one line serves to load the respective valves periodically with the right amount of lubricant, the other serving as a discharge medium.

Other pressure greasing systems involve electric power or compressed air. Certain of these are designed to eliminate the necessity for springs, check valves or restricted port openings. By virtue of the constant pressure which is exerted upon the lubricant, positive flow is insured by elimination of air pockets. It is important to remember that formation of air pockets will be affected by the body of the lubricant, heavier products being more conducive to air pockets.



Courtesy of Morgan Construction Company

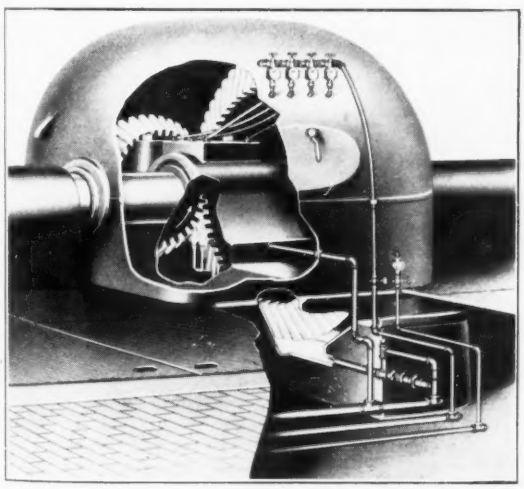
Fig. 2—Cross-section of a top roll bearing of the Morgoil type on the working side of a mill. (A) indicates the sleeve, (B) the thrust bearing ring and (C) locking nut. The casing (D) contains a replaceable bearing liner (E); oil enters at (H) travelling via dotted lines to enter the bearing liner at holes (J).

Methods of Application

The pressure gun has played an important part in the development of certain types of centralized pressure greasing systems. In its usage it can either be designed as a directly connected unit, thereby becoming an integral part of the system, or a portable unit can be used. The portable gun is of decided value as a general piece of plant lubricating equipment, inasmuch as it can be used quite as effectively in connection with individual lubricators as with a centralized system. It can furthermore be used with the spring type of cup with equal dependability.

This combination is decidedly advantageous for the lubrication of inaccessible or hazardously located bearings on many types of machinery. As a general rule, by using a grease cup carrying a spring of particular tension plus a suitable orifice, flow of grease therefrom can be very accurately controlled. Furthermore, it can be noted by observation of the indicator attachment. In many such devices, however, the greatest pressure and consequently the most active flow will be developed just after the cup is filled, decreasing as the spring expands and the lubricator becomes discharged.

It is a simple matter to refill such a cup. Normally it is only necessary to attach the pressure gun to the fitting located in the base

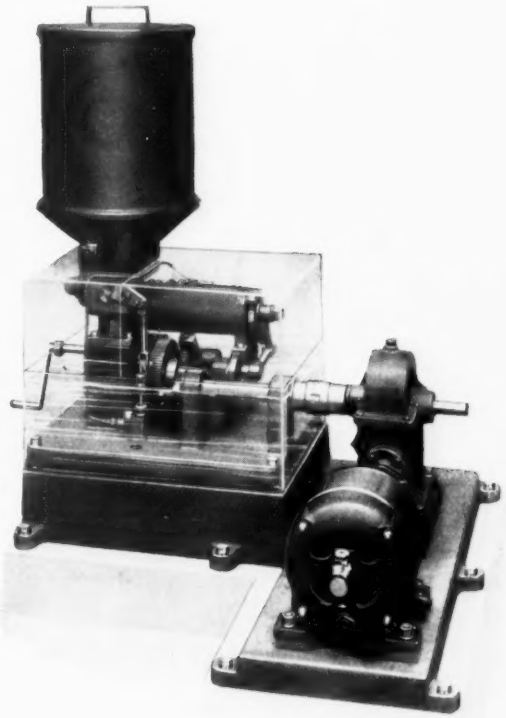


Courtesy of S. F. Bowser and Co., Inc.

Fig. 3—Showing adaptation of pressure oil circulation to a set of steel mill gears, pinions and their respective bearings, in order that spray of oil is applied to the gears at point of mesh. This may be applied either above or below, according to direction of rotation. The washing action of the oil not only keeps the gear teeth clean and cool, but also performs the same function for the bearings.

of the cup and work the discharge of the gun until the indicator shows the cup to be filled. There is no necessity for removal of the cover, as may be true with those cups which are more strictly of the hand pressure type. In consequence there is more positive assurance that the grease charge will not become contaminated by dust or dirt in the course of handling.

Compressed air, electric power, or simply hand or foot power can be used in connection with pressure gun operation, according to the type of gun and the pressure desired. Mechani-



Courtesy of Hills-McCanna Company

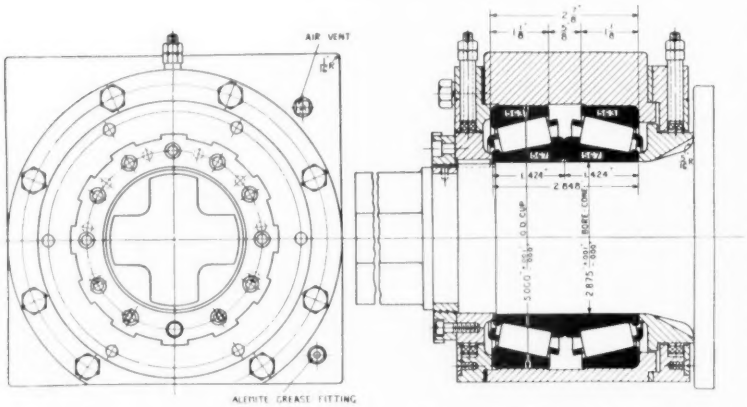
Fig. 4—Details of a mill type grease pump, showing in phantom the respective location of the operating parts. Note that these latter run in a bath of oil.

cal power develops considerably higher pressures, of course, than man power. Where a relatively simple hand pressure grease gun is used, the impression may be gained that this should be classified with the hand pressure or screw-down type of cup. Hand pressure as applied to a grease gun, however, does not react directly on the bearing; it must first be converted to mechanical energy by doing work in compressing the spring in the grease cup. From this point on lubrication is automatically maintained by the mechanical action of the spring upon the adjacent plunger which bears upon the grease charge to force it to the bearing clearance space.

Direct Attachment Affords Higher Pressures

The power driven grease lubricator is adaptable to service where grease lubrication is essential, under considerably higher pressures than can be attained through the average

spring type of cup. Here positive and complete cleaning of bearing grooves and clearance spaces prior to re-lubrication will be of primary importance, especially where conditions of operation may be conducive to entry and accumulation of dust, dirt, or other non-lubricating foreign matter. Direct application of grease by means of a pressure gun insures such protection.



Courtesy of The Timken Roller Bearing Co.

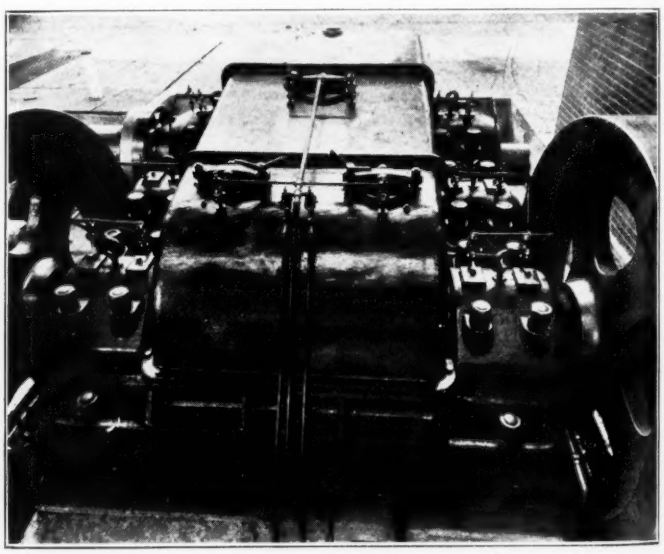
Fig. 5—Constructional details of a Timken mill type bearing, showing relative location of air vent and grease fitting.

Regardless of the actual means of application, however, use of the pressure gun in virtually any form requires a certain amount of manual handling. The gun itself must be moved about, flexible hose must be handled, fittings must be wiped clean before attachment of the hose or gun connection, and finally the gun must be put into operation. All this requires time, care and good judgment. The latter is especially essential in determining when a bearing has been completely re-lubricated. Recent studies of certain bearing designers has indicated that the amount of grease fed to a bearing can be controlled by judicious installation of a suitable vent in the upper part of the bearing. See Fig. 5. Vents also serve to relieve any pressures within the bearings, to prevent the development of back pressures upon the lubricants, which might cause leakage around the housing, in case the lubricants could not expand freely should temperatures be increased.

Concentration of pressure gun fittings at a central panel or point of control will also aid in reducing the labor essential to lubrication. This has been accomplished with such success that today it can be safely stated that not only in the steel industry, but also in other phases of production where heavy duty machinery is involved, centralized pressure grease lubrication is a practicable and comparatively economical procedure, distinctly advantageous in enabling reduction of hazard by concentrating equipment in a safe location.

Pressure Insures Clearing of Bearings

The value of pressure in forcing out old grease and dirt from certain types of bearings has been definitely proved. Judgment is necessary, however, in determining when this has been completely accomplished and when to shut off the pressure and cease forcing in new grease. If properly done, such a method of lubrication is decidedly economical. On the other hand, if the operator is careless, unobservant, or continues to apply lubricant beyond the necessary extent, he will not only waste grease, but may also cause development of a sloppy condition around the bearings. A slight bulge of fresh grease at a bearing end will usually indicate that complete re-lubrication has been accomplished, and minimum of waste of new product will result.



Courtesy of S. F. Bowser and Co., Inc.

Fig. 6—External view of a 6 bearing gear set, showing manner of installation of oil leads and usage of sight feed equipment.

Constant pressure may be detrimental with

certain greases, causing them to separate. For this reason the use of pressure should be carefully studied with respect to the type of grease and length of distributing pipes.

Designs

Mention has been made that pressure lubricators can be of either the hand or power type. For unit or individual machine service the former is often the most suitable device, due to its ability to operate by means of hand or foot pressure. Grease guns of the hand pressure type will usually be capable of developing several thousand pounds pressure per square inch. They are practicable either with or without hose connections, according to the location of the part to be lubricated and the type of fitting for which they are designed.

It is practicable to apply pressure either before or after attachment of the gun to the fitting. A frequent method of developing pressure is to force down a suitable plunger by

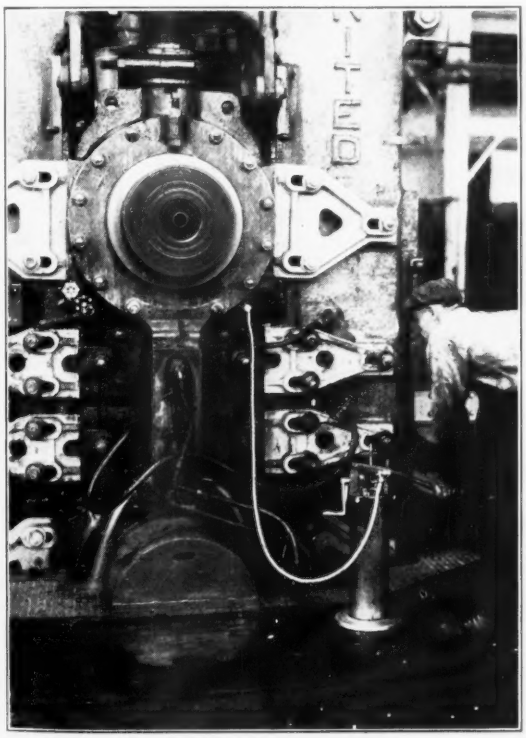
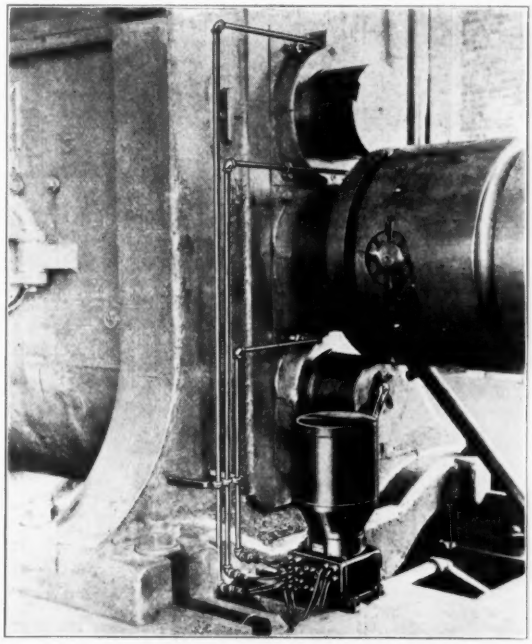


Fig. 7—Showing application of hand pressure grease gun to steel mill bearings.

means of a threaded stem which screws into a bushing in the head of the gun. Another type of gun involves pumping action by means of the handle and a suitable pressure retaining device. Where pressure is to be developed before attachment of the gun to the fitting, a suitable check valve must be installed in the tip. In certain guns the act of attachment opens this valve and automatically permits passage of lubricant to the bearing clearance. This sudden application of fresh grease under adequate pressure is of distinct advantage in clearing the bearing of used lubricant.



Courtesy of United American Bosch Corporation

Fig. 8—Showing a rolling mill pinion stand, equipped for force feed grease lubrication. Note location of grease pump and essential piping.

Rigid connection guns are designed to function with check valves in order to eliminate the necessity of relieving the pressure before detaching the gun from the fitting and to enable pressure to be raised before attachment, to overcome the possibility of twisting off the fitting. The direct or swivel jointed connection also does away with the possibility of leaks in the flexible hose. These factors are especially important where bearings are to be "started" or cleared of grease which has been allowed to remain too long in the grooves or clearance spaces and consequently become gummed, caked and mixed with dirt, or other non-lubricating matter.

The mechanical or power lubricator of considerably greater grease capacity than the hand or foot pressure gun, is particularly adaptable to steel mill service. In general, such lubricators are capable of holding 50 pounds of grease or more. The smaller capacity guns are chiefly of the hand service type; that is, after pressure is developed by power, the grease is discharged by the operation of a pump handle or lever.

A ball or check valve at the base of the pump automatically closes at the end of each stroke to retain all pressure that may have been built up. For efficient operation this check valve must be inspected at frequent intervals to insure cleanliness. In such lubricators pressures of from 1000 pounds upward are readily developed. These pressures are sufficient to handle the usual grades of grease which are applicable to steel mill service where normal pressures and bearing size prevail.

Courtesy of The Chicago Rawhide Manufacturing Co.

Fig. 9—Showing construction of a type of oil seal wherein a flange shaped leather packing member is so formed as to insure complete stoppage of lubricants past the wiping lip of the leather. Friction between the surfaces being sealed is reduced to a minimum by the contour of the leather.

Heavier or more viscous grades of lubricants, however, can be effectively handled by the electric or pneumatic compressor. Such lubricators are usually of higher capacity than the hand service type, in certain cases holding as much as 400 pounds of lubricant. In this latter capacity a multi-lead discharge manifold is frequently installed to enable the lubrication of a number of points simultaneously. Such compressors can be either electrically driven, or designed to take their air from an adjacent compressed air line. In other respects the principles of design of the power lubricator or compressor are much the same as those involved in the hand service type of device.

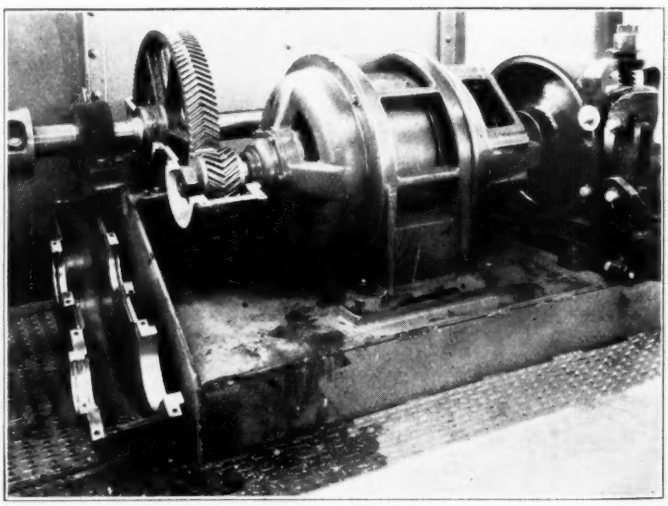
To insure of positive flow, especially at lower temperatures, the distribution piping should be at least one-half inch in diameter.

OIL CIRCULATION UNDER PRESSURE

Circulation of comparatively fluid oils under pressure to certain types of steel mill gears and bearings subjected to intensive duty, and frequently high temperatures, has been developed to a marked degree. A variety of combinations have been worked out, ranging in simplicity from the unit type of gravity feed system to those multiple power devices whereby an entire series of rolling mills can be served by oil under constant pressure.

The extent to which entirely automatic operation should be approached in this regard has been subject to considerable discussion. Certain authorities feel that the unit idea whereby each mill is designed as an individually lubricated unit, will reduce the possibility of extended difficulties should faulty lubrication of any particular part develop.

In the interest of simplicity, gravity circulation of oil in such systems is frequently preferred, with the thought that it will reduce intricacy in construction and the necessity for costly automatic controls. Gravity circulation, on the other hand, is limited in regard to the amount of pressure available. Where this may be low, due to plant limitations, for example, it may affect the viscosity of the oil which should be used. With increased oil pressure, the viscosity can often be somewhat reduced. This reduction in body of the lubricating film is compensated for by the added volume involved and pressure under which the oil is applied to the gear teeth or bearings.



Courtesy of The Clereland Crane and Engineering Co.

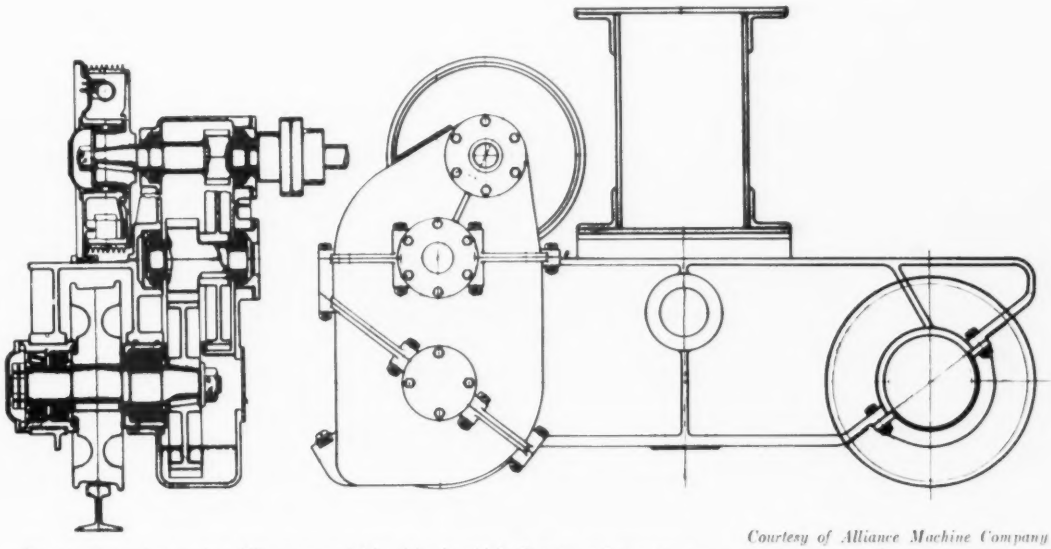
Fig. 10—Showing an overhead crane bridge drive motor, equipped with herringbone gears and oil tight gear case to prevent leakage of lubricant.

Comparative Fluidity a Factor

There are certain factors, however, which will influence the viscosity or comparative fluidity as well as the pressure. The pour test requires special consideration, for in cold weather or under low temperature starting conditions, the rate at which the oil will return to the

settling tanks may be affected. Obviously, if the oil should become too sluggish at any time, flow off from a pinion housing or bearing might be impaired to develop backing up of the oil in the system. Should any bearings be improperly sealed, this oil might find its way to any excess may seriously impair the lubricating ability of any good oil.

The prevention of entry of water into a circulating lubrication system in an existing mill, however, may require the added cooperation of the master mechanic, the engineers who in-



Courtesy of Alliance Machine Company

Fig. 11—General view of an Alliance crane bridge drive in which all gears and bearings are enclosed in cast steel, oil tight, drip-proof housings. Rawhide seals form a part of this installation.

the exterior of the case to develop a sloppy condition on the operating floor and also lead to waste.

Decrease in fluidity of an oil due to an originally too high viscosity or pour test may also develop marked increase in power consumption. This would prevail throughout the system, for not only would the circulating or oil delivery pumps be called upon to do extra work, but also the mill drives themselves might feel the extra duty demanded due to the increase in internal friction within the lubricant itself. Increase in the automatic nature of any such system calls for more careful consideration of these factors of pour test and relative fluidity, for the normally extensive piping layouts and the possibility of development of abnormal friction losses within the system itself may cause reduction in oil flow to a sufficient degree to require severe overloading of the pumps in order to maintain the desired flow to the bearings, gears or pinions, and keep the oil in the supply tanks at the proper level.

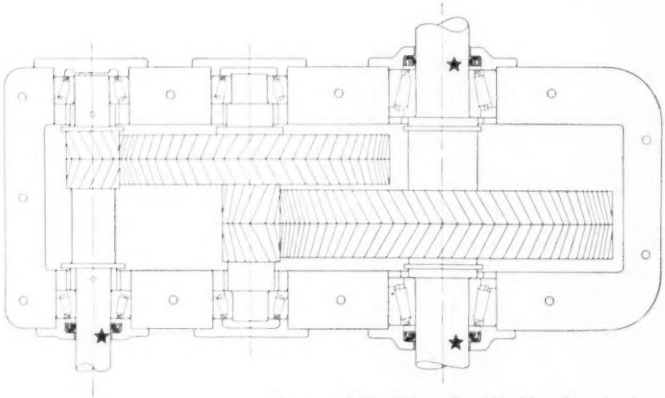
Entry of Water Must be Prevented

Water contamination must be guarded against at all times in the adaptation of pressure circulation lubrication to steel rolling mills. This is essentially a problem which should be forestalled by the designing engineer, in the realization that water contamination to stalled the lubricating system, as well as the lubricating engineer. Water contamination should never be allowed to continue for any length of time, for inevitably it will lead to increased trouble, with the possible necessity for shut-down.

It must be realized that the use of water spray in steel mill practice is especially essential on heavy duty mills, where it is desired to eliminate scale formations. It is surprising the extent to which this water, after passing over the mill and hot metal, will find its way to the bearings and drives, however carefully they may be constructed. Furthermore, at a temperature of very nearly the boiling point, water will have a decided tendency to react physically with any oil with which it comes in contact, to cause formation of permanent emulsions which may be very difficult to break. Fortunately, water traps in settling tanks have been found to aid materially in removing a considerable amount of such water before it has time to affect the oil. All points wherein water may gain entry into such a lubricating system should be carefully sealed as added insurance. This can be accomplished in many cases by caulking surface joints with oakum, and covering with molten lead.

With bearings, however, attention should be directed to their original design, in order to provide for some recognized method of sealing,

which will not impair in any way the free rotation of the shafts. The use of rawhide seals for this purpose has been studied extensively in this connection.



Courtesy of The Chicago Rawhide Manufacturing Co.

Fig. 12—Showing a crane trolley drive equipped with Timken roller bearings and rawhide leather seals at points indicated by star.

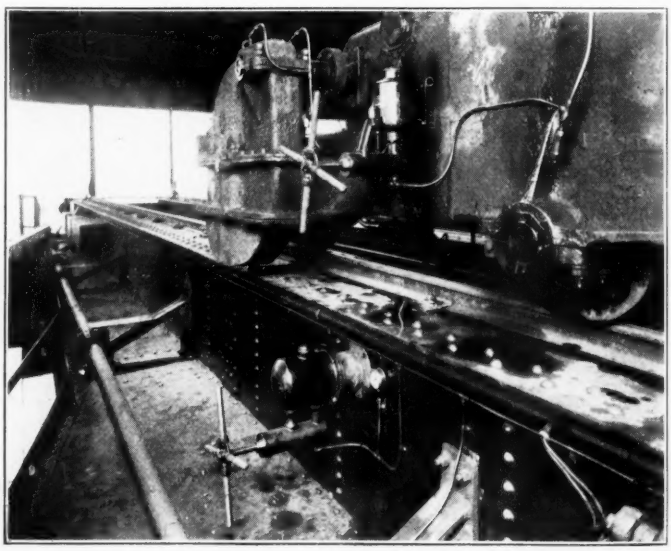
PRESSURE APPLICATION OF GEAR LUBRICANTS

Automatic means for application of gear lubricants under pressure has been developed for the collective lubrication of certain types of reduction gears. The assurance of postive, cleanly and economical application of lubricants to gear teeth is often a problem. This will be particularly true where gears are exposed, or but partly enclosed, for in such installations the tendency of lubricants to be thrown off by the action of centrifugal force must be guarded against. For this reason direction of rotation must be studied. In other words, certain types of lubricants, such as greases, are only applicable to down-meshing gears with any degree of success. With up-meshing gears the frequent necessity for application of such products at the top of the mesh will result in their being thrown off during subsequent rotation due to centrifugal force, although this will depend somewhat upon the viscosity and adhesive characteristics of the lubricant. Where application or relubrication is to be done by hand, these characteristics must be given very careful consideration, otherwise not only may the gear teeth suffer, but also a sloppy condition may prevail, due to the lubricant dripping or being thrown off.

To prevent all this, gears are housed or guarded wherever practicable. In addition, machinery builders have given careful study to development of means for automatic lubrication. The simplest way to attain this, of course, is to enclose at least the lowermost parts of the gears in an oil-tight housing, and provide for bath lubrication. This, however, does not obviate the possibility of more or less of an excess of lubricant being carried out from the bath to be perhaps thrown off from the teeth at some tangent during completion of rotation of the gear. This will be especially possible if too light a product is used, or if it is not sufficiently adhesive to stick to the tooth surfaces.

Where means is provided for constant delivery of gear lubricant to the teeth as they pass into mesh, in about the right amount to maintain lubrication, the above can frequently be checked. Pressure has been developed as being a practicable means of accomplishing this. It may be mechanical, and dependent upon the operation of the machine itself; or the lubricating system may function independently, being power operated.

The adaptation of mechanical drive in lubri-



Courtesy of Lubricating Devices, Inc.

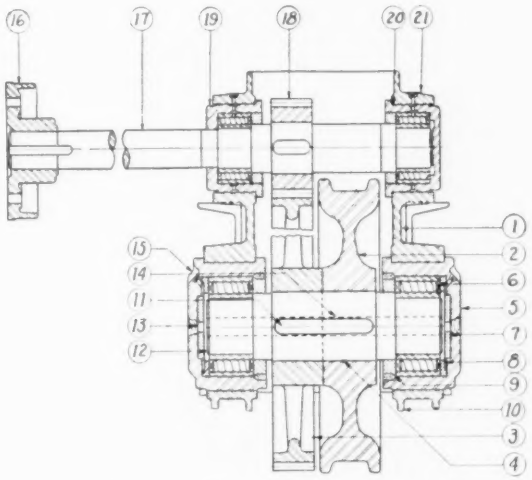
Fig. 13—Side view of a single hoist bridge crane equipped for pressure grease lubrication. Note in particular the grease pump operating mechanism and piping to the respective bearings.

cating heavier duty types of rolling mill gearing will frequently not be practicable. Here the intensity of the service and the volume of oil to be handled will require the use of independently operated power driven pumps. Either steam or electricity can be employed

according to plant facilities, the design of the lubricating system, and the ease with which the necessary piping can be installed.

The use of compressed air power has also been suggested as a means of applying heavier lubricants to exposed gears. In such a system specially designed lubricating pumps equipped with removable lubricant containers can be installed at each point of lubrication. By connecting these pumps to a common air control device, which in turn is supplied with suitable supply and exhaust connections, compressed air from a source adjacent to the machine itself or from an air line elsewhere in the plant can be used to good advantage.

Air is applied at regular and controlled intervals to all the lubricator pumps in the system, simultaneously, to bring about delivery of a predetermined supply of lubricant to each set of gears at their point of mesh. The gear shaft bearings may be similarly lubricated. By driving the air control mechanism directly from the machine to be lubricated, through suitable belt or chain connection, lubrication is only carried out during operation. In such a system comparatively heavy gear lubricants can be used, of a viscosity as high as 1000 seconds Saybolt at 210 degrees Fahr. Such products, if of straight mineral nature, will have a high degree of adhesiveness and but a very small quantity will be required to maintain an adequate protective lubricating film. Application or renewal of lubricant in measured quantities reduces the possibility of dripping or accumulation to a sufficient extent to cause throw-off.



Courtesy of Manning, Maxwell and Moore, Inc., Shaw Crane Works

Fig. 14—Showing Shaw crane equipped with Hyatt roller bearings. Note location of bearing at 6, with a bronze thrust washer with lubricated surface at 7. At 15 is shown the lubrication fitting and a grease equalizer hole at 14.

Lubrication of Overhead Cranes*

Operation of overhead traveling cranes in steel mill service, in the interest of preventing loss of lubricant therefrom and contamination or spotting of sheet steel products during the process of handling, is one of the outstanding problems which has confronted the iron and steel industry for many years.

The effects of oil or grease upon such products, regardless of their gauge, is far reaching. Grease or oil, after it gets on a sheet while the latter is hot, cannot be entirely removed, even in the annealing process. And yet, full finished sheets, or sheets for coating, must be entirely free from grease or oil spots. Pickling thus far has proved unsatisfactory in removing these spots entirely. Sheets to be coated by galvanizing or tinning must be free of scale, and this cleaning is accomplished by pickling. The various acids used will remove scale, but will not remove grease or oil.

It is also important to consider the safety factor. Even though the saving of product should not be sufficient to justify the entire elimination of oil and grease drippage from overhead equipment, regard for the personal safety of the workmen involved will justify every effort that is put forth to reduce this evil to an extreme minimum.

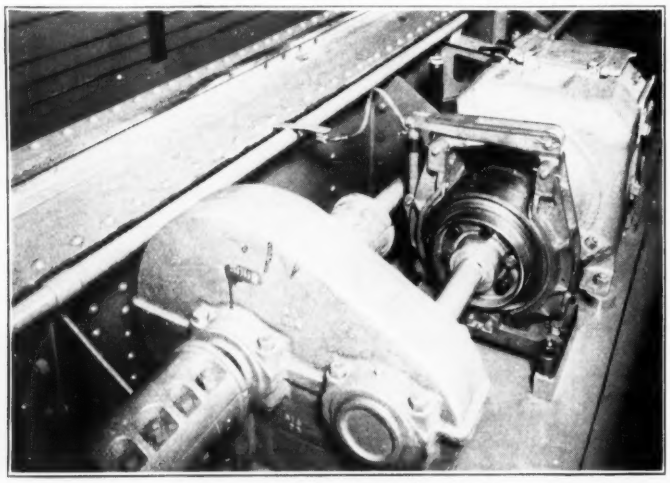
Sheet steel should furthermore be free of spots regardless of whether the process within the mill itself would be impeded due to their existence, in view of the fact that the customer may have a desire ultimately to paint the surface. This applies even to common sheets.

The extent to which dripping of lubricants may occur will, in part, depend upon the design of the equipment. In some of the most modern installations of overhead electric cranes, it has been noticed that dripping still prevails, although not to as great an extent as in older types of machines, due to the fact that equipment manufacturers have given considerable thought to this feature in design and construction. It still remains, however, as a potential detriment and in most cases it can be attributed directly to one of three causes, namely, excess application of lubricant, use of improper lubricants, or carelessness in handling lubricants during the process of application.

In view of the fact that there are any number of plants still operating equipment of the older type, it has been necessary for the management

*Presented before the Association of Iron and Steel Electrical Engineers, Pittsburgh meeting, November 12, 1932

of such plants, in collaboration with the engineers of various manufacturers of lubricants and lubricating devices, to devote a great deal of time and thought in order that the deficiencies of such equipment may be overcome, to bring about competitive production from a manufacturing and marketing standpoint.



Courtesy of Shaw-Box Crane and Hoist Co., Inc.

Fig. 15—Showing general assembly of a Type S Shaw Crane. Note that bearings and gears are sealed to prevent leakage of oil.

A variety of methods prevail for the lubrication of overhead machinery, with none as yet fully standardized. There is, however, considerable attention being given to the matter, both by equipment manufacturers and lubricating engineers, in cooperation with the operating and maintenance departments in the steel industry, for the purpose of devising ways and means to prevent the loss of lubricants as far as possible.

It is a distinct problem in many plants, by virtue of the wide range in operating temperatures which prevails, and the tendency of certain types of lubricants to creep, and ultimately drip from the lubricated parts. High temperature work has the effect of reducing the viscosity of lubricating oils, or the consistency of greases, oftentimes to render them so fluid as to require the most carefully designed seals or housing devices to enable their retention. For this reason the trend has been toward heavier oils and harder greases.

Where oil is employed, waste, felt, or some other absorbent material may be used to take up the excess lubricant after it has seen service. It is also practicable to install drip pans. Unfortunately, however, these latter will require periodic emptying. Saturated waste or felt will also have to be removed, otherwise it will fail to serve its purpose.

It is fair to state, however, that all of the oil and grease damage to sheet steel should not be charged directly to drippage from cranes and their runways, nor to the negligence on the part of the crane oiler or operator. In japanning or enamelling of furniture, or other full finished stocks, a small particle of oil saturated dust, even as minute in size as a pin point, falling onto the sheet after pickling, and before it goes into the annealing box, will expand into a discoloration sometimes as large as a ten-cent piece or a quarter. This is due to expansion of the vapors which results when certain petroleum products are subjected to annealing oven temperatures.

Crane Truck Bearings

Truck bearings of the MCB type, lubricated with oil-saturated waste packing have always been a prevalent cause of oil drippage, not only down onto the product, but also onto the runway and the supporting structural members. This latter condition creates a hazard to the personnel involved which is worthy of great consideration. Careful study has resulted in the conclusion that the use of waste and oil can be discontinued in favor of grease, using a product of semi-solid or comparatively solid consistency. In many plants such a procedure has led to virtually entire elimination of drippage.

In some installations the grease is placed in specially designed pans and held against the journals by means of springs fitted to the underside of the pans. Experience has indicated that this type of lubrication will last for a long time, requiring attention only when regular inspections are made.

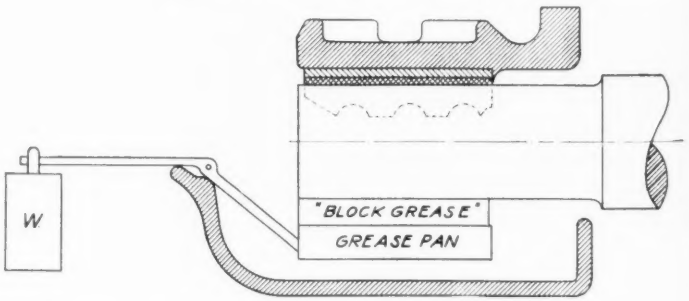


Fig. 16—Showing arrangement for applying block type greases to crane journal bearings to overcome oil drippage.

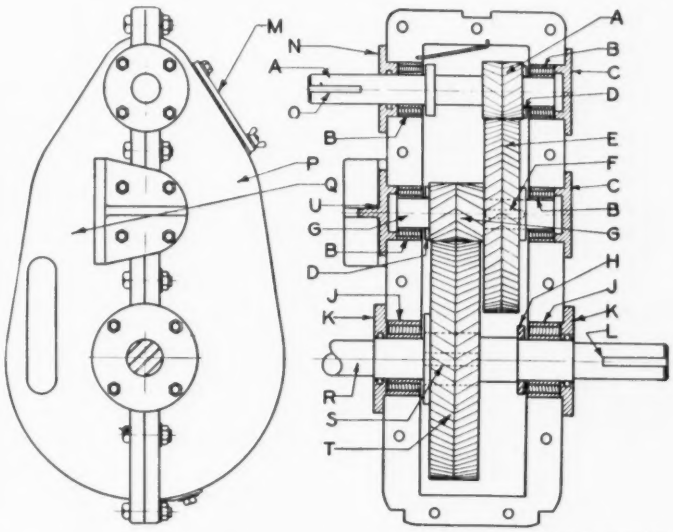
Another method of keeping the grease in close contact with the journal is to use a weight

and lever device, as shown in Fig. 16. In such a device the grease container is from 2½ to 3 inches wide, the length being the same as the bearing, in order to insure that all the wearing surface is in contact with the grease. Pressure can be regulated according to the temperature at which the element is operating, by adjusting the location of the weight on the end of the lever.

It is important to remember, however, that should carelessness prevail, even in the handling of grease while it is being applied to the journal boxes, there is a chance that some of it may drop down later onto the runway and perhaps the product below. This will also apply to the truck bearings of the trolleys, for the MCB bearings on them are treated exactly as are the bearings on the bridge proper.

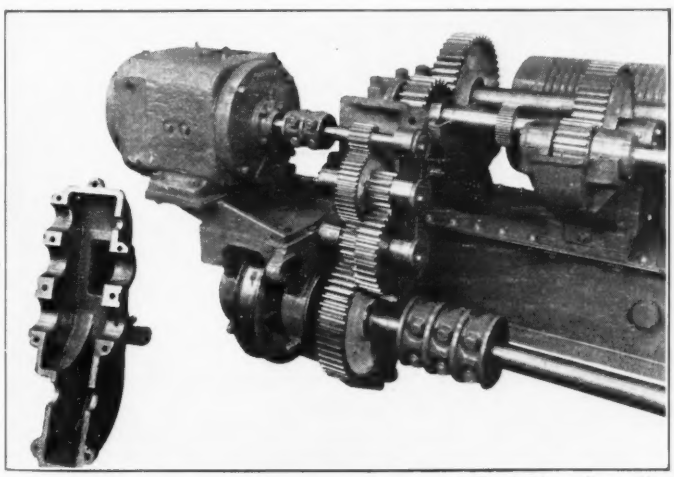
Where cranes are to operate continuously over open hearth furnaces or annealing ovens, it will be essential to resort to a grease of comparatively high melting point, in order to prevent undue reduction in consistency and obviate the possibility of separation.

Grease lubrication is also practicable on cranes equipped with roller bearings. Normally these latter can be more tightly sealed than the plain or sleeve type bearing. On such elements a medium consistency grease of high melting point, containing an oil which has a viscosity in the neighborhood of 175 seconds Saybolt at 210 degrees Fahr., will serve the purpose effectively. It is important to remember, in the use of such a grease, that the consistency must be such as to enable ready application with a hand operated grease gun. As a general rule, the same type of lubricant can be used on all anti-friction bearings on the average crane. The melting point of such a product should be in the neighborhood of 300 degrees Fahr., or higher, and it should indicate absolutely no tendency toward separation.



Courtesy of Whiting Corporation

Fig. 18—Details of a trolley rack drive. At (A) is shown the motor pinion; at (B) and (J), Hyatt Roller Bearing; at (C), (K), (N), and (U), bearing cover; at (D) roller retainer; at (E) motor gear; at (F), (L), (O), and (S) key; at (G) pinion and shaft; at (H) spacing collar; at (M) inspection cover; at (P) and (Q) rack case; at (R) intermediate shaft, and at (T) axle gear.



Courtesy of Harnischfeger Corporation

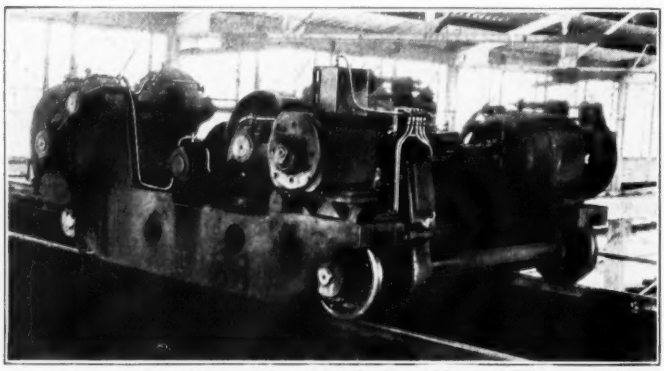
Fig. 17—Showing roller bearing trolley construction with oil tight type of gear case.

Gears and Pinions

The lubrication of gears and pinions depends entirely on the arrangements to keep them lubricated. Where cases are used to enclose these elements, it has been found that the smaller the amount of lubricant used to meet the conditions, the less trouble is experienced. After the teeth are coated very little gear lubricant is required to keep a film on them. The distance between the gear case and the gear or pinion should not be over ½ inch; ¼ inch would be the minimum, inasmuch as sufficient gear lubricant can be carried in a case with such clearance. Furthermore, when this small clearance is used, the drag on the gear or pinion is kept down to a minimum, as well as the leakage, which in turn would lead to dripping.

For such service a straight mineral lubricant, having a viscosity in the neighborhood of 1000 at 210 degrees Fahr., will normally meet the requirements, where gears and pinions are so housed as to prevent leakage of the lubricant.

Should leakage be possible, however, it will be advisable to give careful study to the matter of raising the viscosity of such a gear lubricant, depending upon the type of housing. Frequently in non-oil-tight housings it will be best to apply the lubricant by hand, and guard against any undue accumulation of lubricant in the base of the housing, to result in possible leakage. This will require the use of a product oftentimes as high as 5000 seconds Saybolt at at 210 degrees Fahr.



Courtesy of Rivet, Lathe and Grinder Corp., Blanchard Lubrication Division

Fig. 19—Showing a Blanchard pulsating system for oil supply, installed on the trolley mechanism of a travelling crane. This means of lubrication enables delivery of oil irrespective of direction of operation and obviates necessity for individual attention to any of the bearings.

It is important to remember, however, that in dealing with a lubricant of such high viscosity the congealing effect of low temperatures may lead to a decided increase in power consumption, particularly on starting.

Wire Rope

Wire rope lubricants cannot always be used with positive satisfaction, in view of the wide range of temperatures to which such ropes are exposed, and the fact that they are in direct line with the materials being handled. As a result, any dripping of lubricants from such elements would most assuredly reach these materials. For this reason, best practice would be to specify that the cores of the ropes should be treated during manufacture with a lubricant of heat-resisting characteristics.

Furthermore, it should be free from all fillers. Where a rope core has been treated with a lubricant of this type, the latter will work its way from the core, through the strands of the rope, not only to give additional life, but also to prevent premature corrosion and rusting. It is important to remember that as a wire rope is worked back and forth over the sheave wheels, any contained lubricant within the strands may work out and deposit on the wheels, which might lead to throwing off.

Bearings

In view of the fact that sheave wheel bearings are usually of the sleeve type, they can be effectively lubricated with grease by means of a hand operated grease gun. The amount of lubricant necessary to meet such requirements is comparativly small and gun applications should be carefully controlled in order not to deliver too much lubricant. Otherwise, it might find its way out to the ends of the bearings to drip and cause trouble.

Other sources of drippage are the back axles and the line shafting. While these are usually equipped with an industrial grease fitting of some type, it is generally the practice of the operator to consider that if a little bit of grease is good, a whole lot will be better and, as a consequence, an extra portion is applied.

Motor bearings may also cause similar trouble. If the cavity for lubricant is filled to excess there is bound to be a drippage and, in the case of the trolley motors, due to their passing back and forth over the product being manufactured, there is likely to be damage to the product. Care should be taken in the selection of the lubricant for these bearings, as well as its application. It might be remarked that in most cases that have come under observation, dripping has been due to the tendency to keep motor bearings clean by flushing out with excess lubricant, and the desire of the workman to prevent hot bearings and avoid criticism. The same premise holds true in connection with anti-friction bearings using grease lubrication.

The manufacturers of lubricating devices have given considerable thought and time to the development of centralized lubricating equipment, which once installed and properly adjusted will assist greatly in almost complete elimination of dripped lubricant from overhead equipment. This class of lubricating equipment also greatly reduces the personal hazard.

Paralleling activities have been outstanding in the research studies of the petroleum industry, considerable time and effort having been spent in the development of suitable greases to meet high temperature conditions, capable of application through centralized lubrication systems with the utmost economy.

In summary, it might be said that proper selection of any such lubricant, careful application after it has been selected, and the installation of suitable guards to prevent loss through dripping, will eliminate, to a great extent, the product loss due to drippage of oil and grease during the process of manufacture, and increase the factor of safety from a personnel standpoint.

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